Croton dichromifolius P.I.Forst. (Euphorbiaceae), a new species from Cape York Peninsula, Queensland

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Summary

Forster, P.I. (2010). *Croton dichromifolius* P.I.Forst. (Euphorbiaceae), a new species from Cape York Peninsula, Queensland. ***Austrobaileya* 8(2): 143-149**. A shrubby, perennial species of *Croton* L. from Bolt Head on eastern Cape York Peninsula is newly described. *Croton dichromifolius* P.I.Forst. is highly distinctive in the strongly discolorous foliage with multicoloured peltate scales. A second locality is reported for *Croton simulans* P.I.Forst., another species endemic to Cape York Peninsula. Putative relationships between *C. dichromifolius*, *C. simulans*, *C. capitis-york* Airy Shaw, and *C. stockeri* Airy Shaw are discussed, and an identification key to these Cape York Peninsula species is provided. Conservation status assessments of Vulnerable are recommended for both *C. dichromifolius* and *C. simulans*.

Key Words: Euphorbiaceae, *Croton*, *Croton capitis-york*, *Croton dichromifolius*, *Croton simulans*, *Croton stockeri*, Australia flora, Queensland flora, Cape York Peninsula, new species, taxonomy, identification key, conservation status

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Introduction

A revision of Australian *Croton* L. was published eight years ago with 27 native species recognised (Forster 2003). The existence of an undescribed taxon from Bolt Head on Cape York Peninsula was alluded to in the discussion of *C. capitis-york* Airy Shaw. The absence of fertile material at the time prevented description of this plant; however, recent field collections in November 2008 have remedied this deficit.

This undescribed species is named as *Croton dichromifolius* P.I.Forst. in the current paper. Under the schema of Forster (2003), this species can be placed in **Group 5**, along with *C. capitis-york*, *C. insularis* Baill., *C. mamillatus* P.I.Forst., *C. phebalioides* Muell.Arg., *C. simulans* P.I.Forst. and *C. stigmatosus* F.Muell. This group of species comprises all shrubs or small trees with penninerved foliage that is silver-white below due to a dense adpressed indumentum of trichomes and/or scales. Unpublished molecular data analyses of Australian *Croton* indicates that these species (with *C. stockeri* Airy Shaw added) may form a monophyletic lineage within *Croton* (P. Berry & B. van Ee, *pers. comm.* Feb 2010), and an identification key is provided for the north eastern Cape York Peninsula species of this group.

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Materials and methods

Data presented and discussed in this paper are based on field collections made in 2008 and deposited in the Queensland Herbarium (BRI) with distribution of duplicates as indicated. The morphological description (especially indumentum types) is modelled on those of Forster (2003). Venation terminology largely follows Hickey (1973) and Ash *et al.* (1999) with the recognition of a midrib (1° vein order), lateral veins (2° vein order) and intercostal veins (3° and onwards vein orders) within any leaf lamina. When an intercostal vein comprises a continuous raised line of cells it is termed 'distinct'; if it is discontinuous or fades away into the body of the lamina, it is termed 'indistinct'. Indumentum cover is described using the terminology of Hewson (1988), except that 'scattered' is used instead of 'isolated'. The shapes of leaves, sepals and petals are described using the terminology of Hickey & King (2000). Length and width dimensions are indicated as length × width followed by the measurement unit.

Taxonomy

Croton dichromifolius P.I.Forst., **species nova** *C. capitis-york* affinis, a qua petiolo foliorum squamis densis implicitis peltatis (in illo trichomatibus densis stellatis) induta, folii lamina basi rotundata usque ad infirmissime cordata (cuneata vel truncata in *C. capitis-york*), nectariis extrafloralibus quae tantum infra visibilia sunt (in illo utrinque visibilia), fructibus minoribus depresso-globosis (non subglobosis) indumentis squamarum sparsarum peltatarum et trichomatum sessilium stellatorum (in illo indumentis trichomatum densorum stellatorum in protuberationibus mamillatis) differt. **Typus:** Queensland. Cook District: Bolt Head, Olive River Environmental Reserve, Cape York Peninsula, 16 November 2008, *P.I.Forster PIF34570 & K.R.McDonald* (holo: BRI [3 sheets + spirit]; iso: CNS, L, MEL, MICH, NSW, MO, Z).

Perennial shrub to 5 m tall, evergreen, monoecious; indumentum primarily of sessile peltate trichomes and peltate scales, pale silver-yellow to uncoloured (appearing silver *en masse*), peltate scales generally silver-yellow in central column and uncoloured in the rays, other trichomes uncoloured; 'ginger' scent to cut roots and foliage. Bark nondescript, smooth, cream white. Branchlets ± rounded, with dense peltate scales when young and on most leafy stems, glabrescent; stipules subulate, entire, 1.5–2 × 0.7–0.8 mm, with dense peltate scales. Leaves alternate, coriaceous, markedly discolorous, petiolate; petioles 8–32 × 0.7–1 mm, channelled on top, with dense peltate scales; lamina elliptic-ovate to obovate, chartaceous, 35–113 × 16–63 mm, penninerved with 8–10 lateral 2° veins per side of 1° midrib; upper surface matt to somewhat glossy, mid to dark green, 1° and 2° veins impressed, 3° veins obscure, sparse peltate scales over entire surface, but more concentrated on 1° and 2° veins; lower surface silver-white, 1° and 2° veins prominently raised, 3° veins scarcely raised and indistinct, surface completely obscured by dense, interlocking peltate scales, neither scabrid nor velutinous; margins slightly undulate, not toothed; foliar glands absent; tip acute to acuminate, base rounded to very weakly cordate; extrafloral nectaries 2 at base of leaf lamina, sessile or slightly raised, oblong and often bilobed, 0.8–1 × 0.4–0.5 mm, visible only below. Inflorescence up to 40 mm long, unbranched, usually bisexual and androgynous, often with mixed glomerules, pedunculate to 5 mm, axis with dense, interlocking peltate scales; bracts linear, *c.* 1.5 × 0.2 mm, with sparse peltate trichomes (no scales). Male flowers 1.5–2 mm long, 1.5–2.3 mm diameter, relatively evenly distributed along inflorescence axis in glomerules of 2–4, rarely singly, spaced 2–3.5 mm apart; pedicels 0.8–2.2 × 0.2–0.3 mm, with sparse to dense peltate scales or an admixture of peltate trichomes and scales; sepals valvate, lanceolate-ovate, 1–1.4 × 0.6–1 mm, with dense peltate trichomes or an admixture of peltate trichomes and scales; petals absent; stamens 11 or 12, with dense stellate and simple trichomes at base, filaments filiform, 1.8–2 × *c.* 0.1 mm, glabrous, anthers oblong, 0.4–0.5 × 0.2–0.3 mm, glabrous. Female flowers 2.5–4 × 2.5–4 mm, usually held singly and spaced up to 9 mm apart on inflorescence axis; pedicels 0.8–4 × 0.5–1 mm, with dense, interlocking peltate scales or an admixture of peltate trichomes and scales; sepals valvate, lanceolate-ovate, 1.2–2.5 × 0.8–1.5 mm, with an admixture of peltate trichomes and scales; petals absent; styles 3, linear-flabellate to 1.6 mm long, multifid, once divided for 0.5–0.6 mm, barely connate at base, with scattered stellate trichomes or glabrous; ovary 3-locular, 2–3 mm long, 3–5 mm diameter, with dense, interlocking peltate and stellate trichomes. Fruits trilobate, depressed-globose, 4–6 mm long, 7.5–8 mm diameter, with sparse peltate and stellate trichomes; seeds not seen. **Fig. 1.**

***Additional specimens examined*: Queensland.** Cook District: Bolt Head, Temple Bay, Jun 1996, *Forster PIF19406* (A, CNS, K, MEL); Bolt Head, Olive River Environmental Reserve, Cape York Peninsula, Nov 2008, *Forster PIF34582 & McDonald* (BRI, CNS, MEL).

***Distribution and habitat*:** *Croton dichromifolius* has thus far been found only in the vicinity of Bolt Head, Temple Bay (**Map 2**). Plants grow in the understorey of coastal vineforest (araucarian microphyll vineforest/ semi-deciduous microphyll vineforest) on consolidated, aeolian sand ridges near the sea. It co-occurs with *C. capitis-york* at this locality and no intermediates were observed.

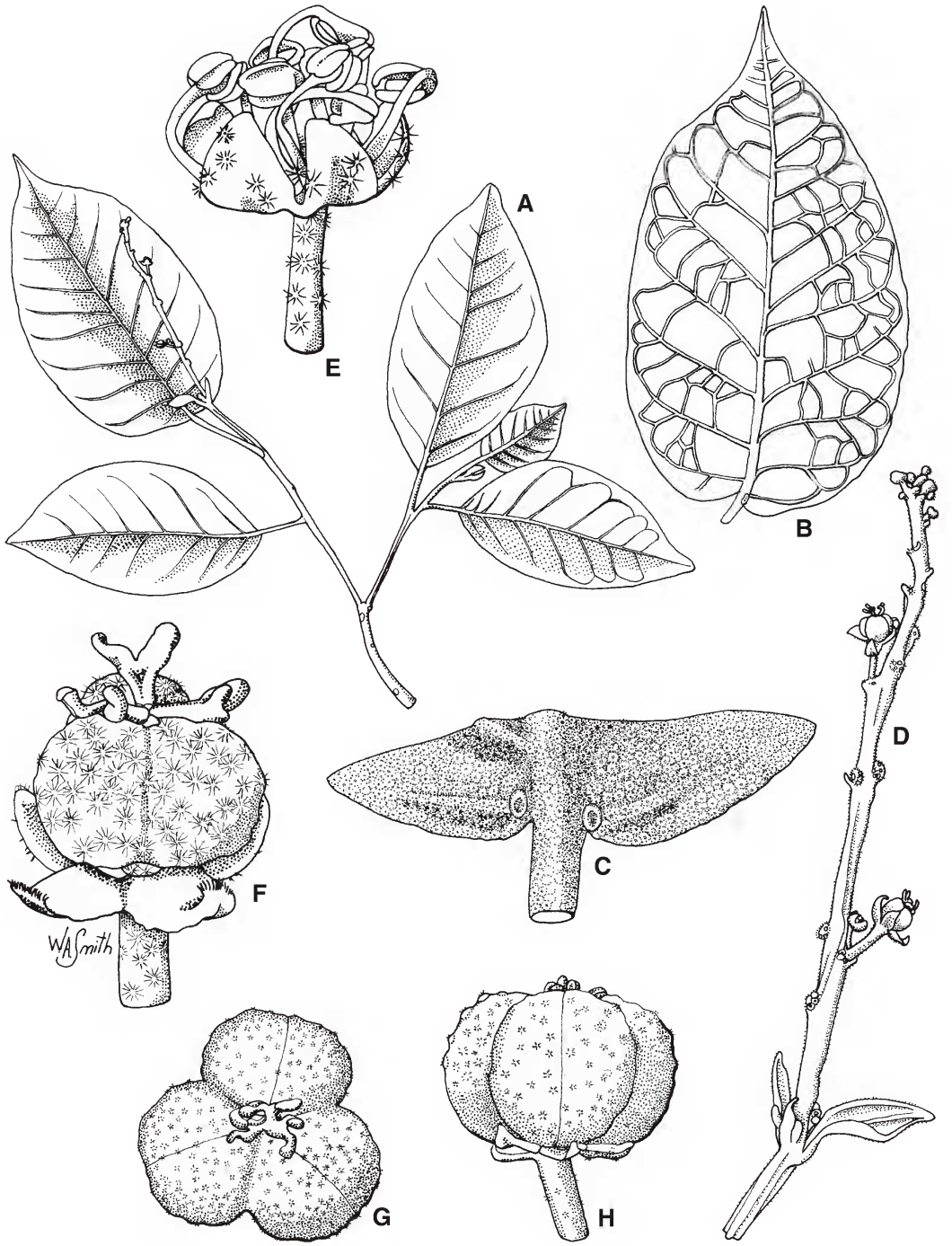


Fig. 1. Croton dichromifolius. A. branchlet with inflorescence × 0.6. B. abaxial leaf surface × 1. C. abaxial leaf lamina base showing extrafloral nectaries × 6. D. inflorescence with male and female flowers × 2. E. lateral view of male flower × 16. F. lateral view of female flower × 8. G. face view of fruit × 4. H. lateral view of fruit × 4. All from *Forster PIF34582* (BRI). Del. W.Smith.

***Notes*:** *Croton dichromifolius* has markedly discolorous foliage, although this in itself is a common character in the genus. The dense, interlocking peltate scales impart a silver-white appearance to the lower surface of the leaf lamina, although on close examination with magnification the scales appear yellow-silver in the central column with only the uncoloured rays appearing silver.

Croton dichromifolius may be diagnosed against *C. capitis-york*, although it remains to be determined with molecular analysis whether the two species are closely related. Compared to *Croton capitis-york*, *C.dichromifolius* has leaves with dense interlocking peltate scales on the petiole (versus dense stellate trichomes), a leaf lamina base that is rounded to very weakly cordate (versus cuneate or truncate), extrafloral nectaries that are visible only below (versus visible above and below); smaller fruit that are depressed-globose (versus subglobose) and with an indumentum of sparse peltate scales and sessile stellate trichomes (versus dense stellate trichomes on mamillate protuberances).

The apparent absence of petals in the male flowers of the available material of *Croton dichromifolius* is unusual as they are present in all other native Australian taxa (Forster 2003). Some predominantly herbaceous taxa of North American and Caribbean *Croton* (*Croton* sections *Eremocarpus* (Benth.) G.L.Webster and *Drepadenium* (Raf.) Müll. Arg.) also lack these petals (Webster 1993), or they are greatly reduced and appear absent on floral dissection. More material of *C. dichromifolius* is required to ascertain whether this is a consistent feature of the species.

***Conservation status*:** *Croton dichromifolius* is abundant at Bolt Head, where it occurs in a vegetation community that is home to several local, or near local endemics, e.g. *Cycas silvestris* K.D.Hill, *Syzygium argyropedicum* B.Hyland, *Xanthostemon youngii* C.T.White & W.D.Francis and *Xylosma* sp. (Temple Bay P.I.Forster PIF8980).

There are no obvious threats to the habitat of *Croton dichromifolius*; however, the area of occurrence is less than 50 km² and the area of occupancy much smaller. Under the *IUCN* (2001) criteria, this species can be assessed as **Vulnerable** on the criterion D2.

***Etymology*:** The specific epithet is derived from the Greek *dis* (double), *chroma* (colour) and *folius* (leaf) and alludes to both the strikingly discolorous foliage and the two coloured peltate scales prevalent on the foliage.

Croton simulans P.I.Forst., *Austrobaileya* 6: 412 (2003).

***Additional specimen examined*: Queensland.** Cook District: 6.5 km W of Shelburne Bay, 5.5 km W of Messum Hill, Cape York Peninsula, Jun 2008, *Forster PIF33941 & McDonald* (BRI, CNS, MEL).

***Distribution and habitat*:** *Croton simulans* is now known from two localities on Cape York Peninsula that are disjunct by approximately 230 kmn (**Map 2**). Both populations are in hoop pine dominated vineforest on granite substrates, a vegetation community that is patchily and rather rarely distributed north of the McIlwraith Range.

***Notes*:** This additional collection of *Croton simulans* differs slightly from those at the type locality in the degree and composition of indumentum cover, notably denser stellate trichomes and fewer peltate scales on the leaf lamina. The extrafloral nectaries are also visible above and below due to their position well below the base of the leaf lamina.

***Conservation status*:** *Croton simulans* is present in Kulla (McIlwraith Range) National Park and the Olive River Environmental Reserve. There are no obvious threats to the habitat of *Croton simulans*; however, the area of occurrence is less than 1500 km² and the area of occupancy much smaller. Under the IUCN (2001) criteria, this species can be assessed as **Vulnerable** on the criterion D2. The species should be searched for in other patches of similar habitat, particularly in the area between the McIlwraith and Iron Ranges.

Croton dichromifolius and *C. simulans* may be distinguished from the putatively related *C. capitis-york* and *C. stockeri* with the following identification key.

1 Branchlets with peltate scales only 2
1. Branchlets with admixture of peltate scales and stellate trichomes, or only stellate trichomes 3

2 Leaf petioles with dense stellate trichomes . . . . . **C. capitis-york**
2. Leaf petioles with dense, interlocking peltate scales . . . . . **C. dichromifolius**

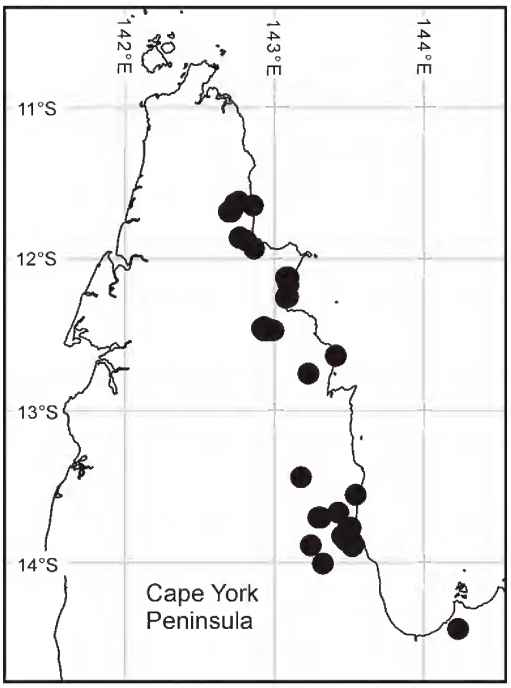
3 Indumentum orange-brown; branchlets with stellate trichomes only . . . . . **C. stockeri**
3. Indumentum silver; branchlets with admixture of peltate scales and stellate trichomes . . . . . **C. simulans**

In the previous identification key to Australian *Croton* (Forster 2003), *C. dichromifolius* will key to *C. capitis-york*.

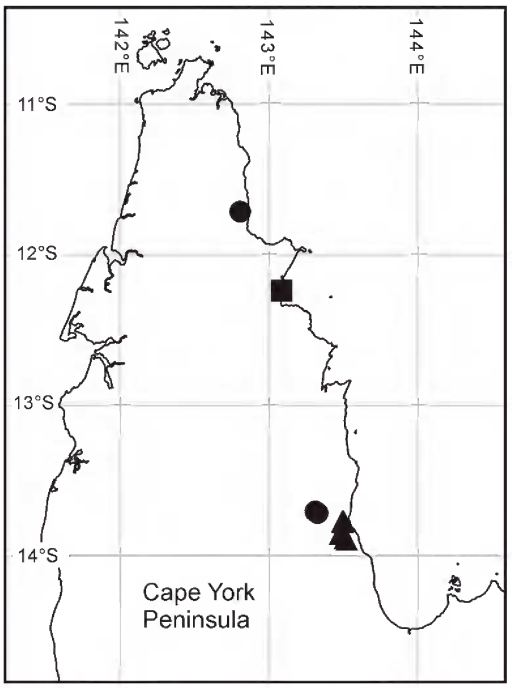
General Discussion

Formal grouping of species within the giant genus *Croton* (over 1200 species world wide) based upon gross morphology is probably doomed to failure, per my earlier comments (Forster [2003] on Webster [1993]). An ongoing molecular project to provide an overall phylogenetic framework for *Croton* (Berry *et al.* 2005) will hopefully provide resolution that can be tied to morphological groups. In this respect the relationship between *C. capitis-york*, *C. dichromifolius*, *C. simulans* and *C. stockeri* is of interest as the grouping comprises one relatively widespread species (*C. capitis-york* in semideciduous vinethickets/vineforests on sandy or lateritic soils derived from Cainozoic duricrusts and sand plains) and three that are highly restricted, of which two (*C. dichromifolius* and *C. stockeri*) are found only in coastal vinethickets/vineforests on stabilised sand dunes and one (*C. simulans*) in hoop pine dominated microphyll vineforests at more inland localities, generally on areas of outcropping granite rock (**Maps 1 & 2**). Taxonomic classification of these four taxa is via differences in indumentum composition and cover, leaf morphology and some floral and fruit characters.

The geomorphology of northeastern Cape York Peninsula is complex, particularly in areas where there are active dune fields. At Bolt Head, Temple Bay (where *Croton dichromifolius* is found), the vineforest occurs on stabilised sand dunes that are probably of Pleistocene origin that overlay Mesozoic sandstone (Pye 1983), and no active dune fields are present. At Silver Plains (where *C. stockeri* occurs), the topographic relief is more subdued with no active dune fields, and the stabilised sand dunes are Pleistocene in origin (Luly *et al.* 2006). There is clear evidence in the form of springs and soakage areas that the Silver Plains vineforest occurs on sand that is shallowly overtopping a large lens of fresh water and considerable drainage in the area ends up in Three-Quarter Mile Lake (Luly *et al.* 2006). One of the known localities for *C. simulans* (the one reported above) at Shelburne Bay has the vineforest patch being enveloped by an active dune field, a phenomenon that is thought to be relatively recent (Holocene) and probably initiated in the Little Ice Age some 300–500 years ago (Pye 1983; Lees *et al.* 1990; Lees 2006). The original locality for *C. simulans* in the McIlwraith Range can be considered to be in a refugial area with the 'dry' hoop pine vineforest on the margins of the 'wet' rainforest along the upland granite watercourses. *Croton capitis-york* by contrast is widespread in a number of disjunct populations in dryer semi-deciduous microphyll vineforests and is far more catholic in its ecophysiological ability to occur on diverse substrates. An evolutionary hypothesis for these four taxa is that *C. capitis-york* is a 'core' species in the older, more widespread and perhaps stable (at least in an ecophysiological sense) habitats, *C. simulans* is a 'refuge-endemic' in older, albeit restricted and disjunct refugia and that *C. dichromifolius* and *C. stockeri* are 'neo-endemics' in newly available areas of habitat.



Map 1. Distribution of *Croton capitis-york* on eastern Cape York Peninsula



Map 2. Distribution of *Croton dichromifolius* (■), *C. simulans* (●) and *C. stockeri* (▲) on eastern Cape York Peninsula

Acknowlegements

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Book Review

The Flowering of Australia's Rainforests – a plant and pollination miscellany. G.Williams & P.Adam (2010). CSIRO Publishing: Melbourne. Hardback, 200 pp, 34 colour photographs. ISBN 9780643097612. $99.95 AUD.

For most flowering plants and gymnosperms, successful pollination is essential for reproduction. Pollination and the vectors that perform it are usually the last aspect considered in any assessment of autecology for a given plant species or community, despite their role being essential in the evolution of species. The body of published work on pollination in Australian rainforests has been previously piecemeal and often hidden in obscure journal papers; hence, this is a welcome synthesis on the subject, albeit with a major backbone of research and theory from the global literature.

This book comprises nine chapters. In Chapter 1, **Flowers and pollination in lore and legend** is examined. This comprises a short review of historical aspects (many biblical or from English poetry), closing with Australian aboriginal examples at the end.

Chapter 2 covers **Categorising rainforest plants**. The authors take a very broad approach by starting with the gymnosperm groups of the cycads and conifers. It was somewhat disconcerting to immediately read basic errors in plant biology and statistics such as "cycads are usually dioecious" (repeated in caption to p. 31) (all cycads are dioecious) and that the Australian cycad flora is "approximately 30 species" (there are about 80 species). Most cycads don't occur in rainforest in Australia, yet, the most interesting ones that do such as *Lepidozamia hopei* (the world's tallest cycad) are not mentioned at all. *Cycas circinalis* is stated to occur in "India, Asia and the South Pacific" (India is part of Asia and this species does not occur in the South Pacific); either way, it doesn't occur in Australia and doesn't grow in rainforest. Comments on conifers are little better with "native conifers are frequently dioecious", "in north-east Australia the Podocarpaceae and Araucariaceae are confined to rainforest" (there are podocarps in eucalypt communities) and "both *Araucaria* and *Agathis* are absent from more complex north-eastern Australian rainforests owing to their inability to regenerate below the dense, shade inducing, floristically complex angiosperm canopies" (which is just plain incorrect). They state that *Euroschinus falcatus* (an angiosperm) is dioecious; however, Jessup (1985) was of the opinion that they were polygamous with male, female or hermaphrodite flowers. While the authors quite openly state that the book is slanted at rainforest systems in New South Wales (nearly all the photos are of species from New South Wales).